

Peer Review Comments on:

Technical Background Document:
Mercury Wastes
Evaluation of Treatment of Bulk Elemental Mercury

and

Technical Background Document:
Mercury Wastes
Evaluation of Treatment of Mercury Surrogate Waste

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“Evaluation of Mercury Surrogate Waste”

1. Was the experimental design of the study appropriate?

The design did not follow the Data Quality Objectives process, nor a similar planning process. As a result, there is little relationship between the objectives and the design. A RCRA disposal scenario was implied, but the pH range did not extend to pH 12.5, and data show, e.g., Figure 5.3, that major changes occur in extraction at high pH.

The QAPP for this study was also included in the electronic file for the evaluation of bulk elemental mercury. A statement of accreditation for the labs could have been substituted for much of the generic material in the QAPP.

2. Was the study conducted properly?

The appropriate procedures were used, and the study appears to have been done as planned.

3. Were the stated objectives adequately met?

The first objective in the peer review charge was to evaluate alternative treatment technologies to obtain a goal of 0.025 mg/L Hg over a range of pH 2 to pH 12. This objective was adequately met with the exception of an apparent sample heterogeneity problem.

The second objective was to compare constant pH protocol results to standard TCLP results. This was adequate with the exception of the apparent sample heterogeneity.

General Questions

1. Are you aware of any other data/studies that are relevant to the assessment of stabilized mercury-bearing wastes and the behavior of these wastes in the environment?

This report does not have a list of baseline references, so the question is very broad. A start would be the studies completed for EPA or used by EPA in previous rule-making. Second would be a literature review using appropriate keywords

2. With regard to the disposal of treated mercury wastes, are additional studies warranted for other factors that impact solubility (e.g., liquid/solid ratio, redox conditions, leachate composition) or affect ability to leach, such as use of macroencapsulation? If you believe that additional studies are needed, please explain why.

An additional study is needed to supplement this report, particularly extractions up to at least pH 12.5. If the mercuric selenide process is considered a viable technology, then mercuric selenide-containing waste should be evaluated over the range of pH 2-12.5 and with varied chloride content in the leachate.

Additional studies on other factors could be done, but the priorities seem to be: pH effects (2-12.5), leachate composition (e.g., chloride) effects, and redox effects. A decision should be made about how accurately a waste treatment evaluation needs to be, then deciding on the relative importance of variables.

3. Do you agree that the following statements are supported by the research results?

a) Site-specific disposal conditions must be considered along with appropriate treatment technology as decisions are made about disposal of mercury wastes.

No. The study provides useful data on pH effects, but it does not provide adequate data to support an absolute requirement for site-specific data. An alternative to using site-specific conditions is a robust treatment standard which addresses the most important variables. A major implementation problem with requiring site-specific conditions is the regulatory feasibility of using site-specific information. For any disposal of hazardous wastes, treated or untreated, it is scientifically preferable to use site-specific conditions as well as the waste properties. It is not obvious that using site-specific data would be better than non-site specific approaches to meet the public health and environmental protection goals, in part because those specific goals are not stated in this report.

b) The presence of chloride ions in a given disposal environment may significantly impact the release from a treated waste form (mercury selenide)

This is discussed in the elemental mercury review.

Any additional comments?

Table 3-1 presumably shows target concentrations and not actual measured concentrations.

Section 3.3.1 lists the worker protection standard as 0.05 g/m³, but Section lists the TLV as 0.025 mg/m³.

The conclusions in Section 5.6 refer to "...waste bulk elemental mercury..." although this study included several forms of mercury.

“Evaluation of Treatment of Bulk Elemental Mercury”

1. Was the experimental design of the study appropriate?

The design followed neither EPA guidance nor requirements for the use of Data Quality Objectives. I could not find the QAPP for this project (the included QAPP appeared identical to the QAPP for the surrogate sludge project), but it apparently dealt with only laboratory QA/QC and not the larger issues of decisions to be made, decision error, and optimizing the plan. Had this been done, the problems of treated waste inhomogeneity, sub-sampling, numbers of samples, and optimizing data collection, e.g., using composite samples, could have been incorporated into the study design. In particular, a clear statement of the decisions could have noted the importance of leaching solids up to at least pH 12.5, the regulatory limit for hazardous waste. Perhaps more important, a statement of acceptable errors should have been included, e.g., a treatment technology must be effective on 90% of wastes with a 90% confidence. Without such a statement, it is difficult to decide when a technology is good enough.

The design of leaching waste treated with mercuric selenide was not consistent with the other leaching tests and only included leaching at two pHs. As a result, the conclusion regarding the effect of chloride could not be compared with the effect of pH over a larger range.

2. Was the study conducted properly?

The lab procedures appear acceptable, although I could not find detailed sampling and sub-sampling procedures. The procedures appear to have been carried out correctly.

3. Were the stated objectives adequately met?

The first review objective was to “evaluate the effectiveness of alternative treatments to obtain a goal of 0.025 mg/L TCLP over a range of pH 2 to pH 12.” I assume the reference to TCLP is a mistake, and the objective is to review the results of the constant pH extraction. With this assumption, the data collected were adequate to do the evaluation, with the exception of an apparent sample heterogeneity problem.

The second review objective was to compare constant pH protocol results to standard TCLP results. The data were adequate for this comparison, with the exception of sample heterogeneity.

The third review objective was to evaluate the effects of increased chloride concentration of mercuric selenide at constant pH conditions. These data were not adequate since only two pHs and two chloride concentrations were used; the

results were inadequate to quantitatively compare the chloride effect with the pH effect.

General Questions

1. Are you aware of any other data/studies that are relevant to the assessment of stabilized mercury-bearing wastes and the behavior of these wastes in the environment?

This report does not have a list of references, so the question is very broad. A start would be the studies for EPA or used by EPA in previous rule-making. Second would be a literature review using appropriate keywords.

2. With regard to the disposal of treated mercury wastes, are additional studies warranted for other factors that impact solubility (e.g., liquid/solid ratio, redox conditions, leachate composition) or affect ability to leach, such as use of macroencapsulation? If you believe that additional studies are needed, please explain why.

An additional study is needed to fill the holes in this report, particularly extractions up to at least pH 12.5. If the mercuric selenide process is considered a viable technology, then mercuric selenide waste should be evaluated over the range of pH 2-12.5 and with varied chloride content in the leachate. Additional studies on other factors could be done, but the priorities seem to be: pH effects (2-12.5), chloride effects, and redox effects.

3. Do you agree that the following statements are supported by the research results?

a) Site-specific disposal conditions must be considered along with appropriate treatment technology as decisions are made about disposal of mercury wastes.

No. The study provides useful data on pH and chlorides, but it does not provide adequate support for an absolute requirement for site-specific data. An alternative to using site-specific conditions is a robust treatment standard which addresses the most important variables. A major implementation problem with requiring site-specific conditions is the regulatory feasibility of using site-specific information. For any disposal of hazardous wastes, treated or untreated, it is scientifically preferable to use site-specific conditions as well as the waste properties. It is misleading, however, to pursue this path unless the regulatory system has the flexibility to implement efficiently to provide the necessary protection to public health and the environment.

b) The presence of chloride ions in a given disposal environment may significantly impact the release from a treated waste form (mercury selenide)

Yes, the data in the report do support this statement. However, there is no comparison with other variables, not even an adequate comparison with pH, which shows the relative importance of chloride concentration.

Any additional comments?

Some minor editing was needed for the final reports, i.e., spaces and placement of hyphens.

Data on the quantities of listed wastes would have been useful to understand the magnitude of various waste treatment problems.